KUS550 Series Ultrasonic Sensor
MODBUS Protocol（version V3.0）

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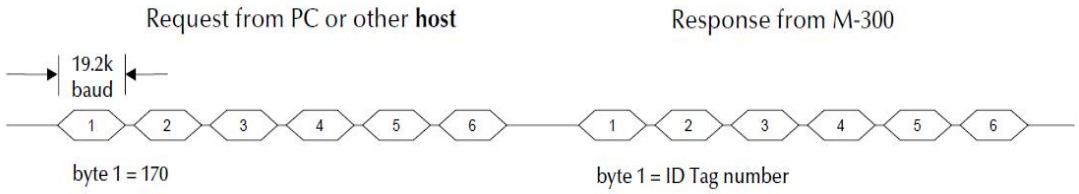
1.Communications Protocol

The data rate defaults to 19200 baud. Each byte contains 10 bits including a start bit, 8 bits of data, 1 stop bit, and no parity bit. A total of 6 bytes are required to access the KUS550. The KUS550 will respond with 6 bytes including status (range to target, temperature, target intensity, etc.), data memory read request, and sensor error message on the RS485 bus. Transmitted values are binary.



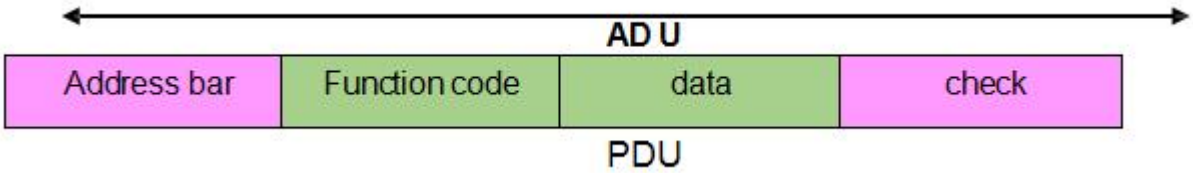
2. Sensor Commands

Each command has a total of 6（or 8）bytes, and all sensor commands are sent and displays by HEX. The sensor ID Tag uses 01 as an example.

2.1 Modbus Commands

2.1.1 Protocol description

MODBUS protocol defines a simple protocol data unit (PDU) independent of the underlying communication layer. On a particular bus or network MODBUS protocol mapping can introduce additional domains on application data units (ADU).



Clients that initiate MODBUS transaction processing create MODBUS application data units. The function code indicates to the server where to execute Kind of operation.

2.1.2 Modbus Message Framing

1）Request command

Sensor ID	Function code	Data address	Data length	Check sum(CRC16)
1 byte	1byte	2 byte	2 byte	2 byte

Supported function code:

(1) Read Holding Register (03)

(2) Preset Single Register (06)

Example for Read Holding Register (03).

Command is 01 03 00 00 00 01 84 0A for reading 00 register length = 1

01 03 01 00 00 03 04 37 for reading status info(0x100) and distance(0x101) and temperature(0x102)

Command is 01 03 01 01 00 02 94 37 for reading distance and temperature

Command is 01 03 01 01 00 01 D4 36 for reading distance(0x101)

2）Response

Sensor ID	Function code	Data length	Return data	Check sum(CRC16)
1 byte	1byte	1 byte	(Data length)*2 byte	2 byte

Example:
Tx: 01 03 00 00 00 0A C5 CD
Rx: 01 03 14 06 01 00 00 0E 01 13 A5 00 01 07 D0 00 00 00 00 03 FF 19 16 5F 27
Tx: 01 03 01 00 00 03 04 37
Rx: 01 03 06 00 08 18 6D 00 0A D7 CE
Tx: 01 03 01 01 00 02 94 37
Rx: 01 03 04 18 78 00 0B 3D 4D
Tx: 01 03 01 01 00 01 D4 36
Rx: 01 03 02 18 6A 32 6B

Example for Preset Single Register (06):
Change the baud rate to 38400bps.
Step1: Read the register 0x00
Tx:01 03 00 00 00 01 84 0A
Rx:01 03 02 06 01 7A 24
Step2: write 0x0701 to 0x00
Tx:01 06 00 00 07 01 4A 3A
Rx:01 06 00 00 07 01 4A 3A
Setp3: write 0x00 to address 0x100 to reboot the sensor
Tx:01 06 01 00 00 00 88 36
Rx:01 06 01 00 00 00 88 36
Step4: Change the host baud rate to 38400bps and reconnect

2.2 Normal operation for the sensor

The following are some common operations of sensors, such as changing the liquid level sensor to a distance sensor, changing the measurement result unit, changing the measurement cycle, and changing the baud rate.

2.2.1) Reboot the sensor

Write any value to register 0x100 to reset the sensor.
Write 0x0000 to register 0x100 to reset the sensor.
Tx:01 06 01 00 00 00 88 36
Rx:01 06 01 00 00 00 88 36

2.2.2) Change the slave sensor ID

Step 1: Query the sensor ID, the default value is 0x01
Tx: 01 03 00 15 00 01 95 CE
Rx: 01 03 02 03 01 79 74 The lower eight bits of 0x0301 in the returned data are the Modbus slave ID.

Step 2: Change the ID to 2
Tx: 01 06 00 15 03 02 19 3F
Rx: 01 06 00 15 03 02 19 3F Write 0x0302 to the lower eight bits of the 0x15 register, which is the address.
Step 3: Activate the new ID by restarting the sensor
Tx: 01 06 01 00 00 00 88 36
Rx:01 06 01 00 00 00 88 36

2.2.3) Change the measure type from distance mode to liquid level mode.

Query the register list and find that the high eight bits of register 0x23 set the measurement result to liquid level or distance.
Step 1: Read the measurement result
Tx: 01 03 00 23 00 01 75 C0
The high eight bits of the query address 0x0023 are the result type register. When it is 0, the measurement result is distance, and when it is 1, the measurement result is liquid level.
Rx: 01 03 02 00 00 B8 44
The query address 0x0023 results in 0x0000. The high eight bits indicate that the measurement result is distance, and the low eight bits indicate that the output is linear output.
Step 2: Set the depth of the water tank (depth is 20000mm)
Tx: 01 06 00 25 4E 20 AC 79
Set register 0x25 to 0x4e20, 0x4e20 is 20000, 0.1 mm unit, that is, 2000 mm
Rx: 01 06 00 25 4E 20 AC 79
The setting is successful, the result is 0x4e20.
Step 3: Change the measurement result type
Tx: 01 06 00 23 01 00 79 90
Leave the lower eight bits of register 0x23 unchanged.
Rx: 01 06 00 23 01 00 79 90
The result is 0x0100.
Step 4: Reboot to activate the setting.
Tx: 01 06 01 00 00 00 88 36
Rx: 01 06 01 00 00 00 88 36

2.2.4) Change the measure type as distance.

Step 1: Read the measurement type register
Tx: 01 03 00 23 00 01 75 C0
Query the 0x23 register. When the upper eight bits are 0, the measurement result is distance. When they are 1, the measurement result is liquid level.
Rx: 01 03 02 01 00 B9 D4
The query result 0x0100 upper eight bits are 0x01, indicating that the measurement result is liquid level.
Step 2: Change the measurement result type to distance
Tx: 01 06 00 23 00 00 78 00
Set the 0x23 register to 0x0100, the lower eight bits remain unchanged, and the upper eight bits are set to 0x00 for distance.
Rx: 01 06 00 23 00 00 78 00
The result is 0x0000.
Step 3: Reboot to activate the setting.
Tx: 01 06 01 00 00 00 88 36
Rx: 01 06 01 00 00 00 88 36

2.2.5) Inquiry the slave address (ID) of the sensor

This operation is used when the sensor ID is unknown. This method reads the 0x15 register from the address by sending a broadcast command

Tx: 00 03 00 15 00 01 94 1F

Rx: 01 03 02 00 01 79 84

The address ID is 0x01.

Note: The ID address is still 28 before v2.4, the address of V2.5 products is 0x2A, and the address of V2.6 is 0x15.

2.2.6) Modify the measure period.

The default measurement result is 5Hz, which means the measurement period is 200ms and 1LSB is 25ms.

Step 1: Query the period register 0x32, 0X33.

Tx: 01 03 00 32 00 02 65 C4

Query the 0x32 register.

Rx: 01 03 04 00 00 08 FF BD B3

The result is 0x000008, which is the period parameter, and the period is 8*25ms=200ms

Step 2: Set the new period to 0x000009 to modify the period to 225ms

Tx: 01 06 00 33 09 FF 3F D5

Set register 0x33 to 0x09 and keep 0x32 unchanged.

Rx: 01 06 00 33 09 FF 3F D5

The result is 0x09ff.

Step 3: Restart to activate settings

Tx: 01 06 01 00 00 00 88 36

Rx: 01 06 01 00 00 00 88 36

2.2.7) Modify UART Baud rate as you want

Look up the appendix table for register 0 and get the correct baud rate setting. The default baud rate is 19200bps and the parameter is 6. For example, to change the baud rate from 19200 to 57600, register 0 should be changed from 6 to 8.

Step 1: Query the register values of 0x00 and 0x01

Tx: 01 03 00 00 00 01 84 0A

Rx: 01 03 02 06 01 7A 24

Step 2: Set register 0x00 to 8 and keep register 0x01 unchanged

Tx: 01 06 00 00 08 01 4F CA

Rx: 01 06 00 00 08 01 4F CA

Step 3: Restart to activate the settings

Tx: 01 06 01 00 00 00 88 36

Rx: 01 06 01 00 00 00 88 36

Step 4: Change the host baud rate to the same 57600.

2.2.8) Analog output and switching output

If you want to use the switch mode, you need to purchase the version with switch output. Look up the register directory, the lower eight bits of register 0x23 (35) define the analog output type = 0x00 for linear analog output, = 0x01 for switch output, and the analog output has two set points, the near set point is called A1, and the far set point is called A2. The output changes with the distance. Let's demonstrate the setting method below. When the distance is less than A1 (500mm), the output is 4mA, when the distance is A1 (500mm) to A2 (2000mm), the output is 4-20mA, and when the distance is greater than A2 (2000mm), the output is 20mA.

If the analog output is 0-10V, then the above 4mA and 20mA will be 0V and 10V.
The switch or analog mode will be set at the factory, and the customer does not need to set it by himself.
Note: The near and far points cannot exceed the blind area and the maximum range!

The following three steps are examples of setting the 4-20mA corresponding to the near and far points:
Step 1: Query and set A1 to 500 mm (write 5000 (0x1388) to the 0x24 register)
Tx: 01 03 00 24 00 01 C4 01
Rx: 01 03 02 07 D0 BB E8
Tx: 01 06 00 24 13 88 C4 97
Rx: 01 06 00 24 13 88 C4 97
Step 2: Query and set A2 to 2000mm (write 20000 (0x4E20) to the 0x25 register)
Tx: 01 03 00 25 00 01 95 C1
Rx: 01 03 02 61 A8 90 6A
Tx: 01 06 00 25 4E 20 AC 79
Rx: 01 06 00 25 4E 20 AC 79
Step 3: Restart to activate the settings.
Tx: 01 06 01 00 00 00 88 36
Rx: 01 06 01 00 00 00 88 36

The following five steps are examples of setting the switch corresponding to the near and far points and the switch mode. The switch mode is set to open when the distance is within B1 and B2:
Step 1: Query and set B1 to 500 mm (write 5000 (0x1388) to register 0x28)
Tx: 01 03 00 28 00 01 C4 01
Rx: 01 03 02 07 D0 BB E8
Tx: 01 06 00 28 13 88 C4 97
Rx: 01 06 00 28 13 88 C4 97
Step 2: Query and set B2 to 2000mm (write 20000 (0x4E20) to 0x29 register)
Tx: 01 03 00 29 00 01 95 C1
Rx: 01 03 02 61 A8 90 6A
Tx: 01 06 00 29 4E 20 AC 79
Rx: 01 06 00 29 4E 20 AC 79
Step 3: Query and set the switch mode output register (0x2C) and write 0x04FF to it.
Tx: 01 03 00 2C 00 01 05 C2
Rx: 01 03 02 05 FF F4 A4
Tx: 01 06 00 2C 04 FF 0B 13
Rx: 01 06 00 2C 04 FF 0B 13
Step 4: Query and set the output to switch output (write 0x01 to the lower eight bits of the 0x23(35) register)
Tx: 01 03 00 23 00 01 75 C0
Query the 0x23 register to obtain the value of the upper eight bits, write it back to the register, and keep the upper eight bits unchanged
Rx: 01 03 02 00 00 B9 D4
Tx: 01 06 00 23 00 01 98 54
Set register 0x23 to 0x0001
Rx: 01 06 00 23 00 01 98 54
Step 5: Restart to activate the settings.
Tx: 01 06 01 00 00 00 88 36
Rx: 01 06 01 00 00 00 88 36

2.2.9) How to modify the measurement time and average sampling times

In the actual measurement process, customers may need to modify the measurement cycle. The default detection cycle of our products is 200 ms, (the default register value is 0x000008, 1lsb=25ms). Of course, customers can also modify the measurement time according to their actual situation. The measurement cycle is defined by a 24-bit register, which is a combination of registers 0x32 and 0x33. Therefore, the maximum cycle is 0xFFFFFF*25ms=419430 seconds, and the minimum cycle is 0 ms (register value is 0, the actual cycle is about 15ms).

Here is an example of how to measure every 5 minutes.
If you want to modify the cycle to 5 minutes, the register value can be calculated as follows:
5*60 *1000 /25= 12000 (0x002EE0), so the value in registers 0x64 0x65 and 0x66 is 0x002E00.
Modifications are as follows:

Step 1: Modify the register value and change the measurement time to 5 minutes

Tx: 01 06 00 32 00 2E A8 19
Rx: 01 06 00 32 00 2E A8 19
TX:01 06 00 33 E0 FF 70 45
Rx:01 06 00 33 E0 FF 70 45

Step 2: Reset and restart the system to make the new parameters effective.

Tx:01 06 01 00 2E E0 94 1E
Rx:01 06 01 00 2E E0 94 1E Reset and restart successfully

There is a rule to note here, because the average window minimizes the measurement error by averaging the last server time measurement result. If the measurement period is too long, the average value is meaningless. So the average window should be changed to 0. This example is actually a requirement raised by the customer. We modified the cycle and changed the default average window size of the software from 4 to 0 (which means that the output value has been changed from the average of 16 tests to a single test value). The customer requires that the measurement be output every 5 minutes. If the average output is used, the average value will be output in combination with the previously measured values in the last output of the set average number of times. Because the customer's measurement requirements require that the liquid level constantly changes slightly, the change in the liquid level will become larger and larger as time goes by, which will cause errors in the average output, so we should output a single test value each time.

(0 = one sample output, 1 = 2 samples to take the average output, 2 = 4 samples to take the average output, 3 = 8 samples to take the average output, 4 = 16 samples to take the average output, 5 = 32 samples to take the average output, 6 = 64 samples to take the average output, 7 = 128 samples to take the average output, 8 = 256 samples to take the average output, 9 = 512 samples to take the average output, 10 = 1024 samples to take the average output.)

Note: How to change the average window to 4 (16 samples to take the average output):

Step 1:

Tx: 01 06 00 2D 05 04 1B 50
Rx: 01 06 00 2D 05 04 1B 50

Step 2:

Tx:01 06 01 00 00 00 88 36
Rx:01 06 01 00 00 00 88 36 Reset and restart

3. Low power working mode

There are some ways to reduce power consumption

1. Modify the measurement period to the largest acceptable range by modifying register 0x2F.
2. Change the working mode to sleep mode:

Step 1:

Tx: 01 06 00 2F 02 00 B9 63

Rx: 01 06 00 2F 02 00 B9 63

Step 2:

Tx: 01 06 01 00 00 00 88 36

Rx: 01 06 01 00 00 00 88 36

3.1 Startup time in sleep mode

Send a preamble in sleep mode. After sending the preamble, the user can receive the returned data packet within a certain period of time. If this time period is exceeded, it will cause intermittent reception of the returned data packet. This period is the time from the system working to send the preamble to the next sleep. As long as the command is sent during this period, the return command can be received. In the system, the longest time is set to 300ms, and the shortest is 1ms.

Note: In theory, after sending a data packet, the returned data packet will be received within 80 milliseconds.

3.2 Simple description of four working modes

Mode 0: Full-function mode In this mode, the sensor works normally, measures results regularly, and filters and calculates to save the measurement results.

Mode 1: In mode 1, the sensor remains silent. The serial port will only report the measurement results when the host computer sends a query command.

Mode 2: Sleep mode. In sleep mode, a modbus query command with a wake-up code needs to be sent before the sensor starts measuring and returns the measurement results. After receiving the wake-up code, the sensor will remain active within 50ms. During this 50ms, the host computer can send a normal modbus query frame or modification frame. During this period, the sensor will respond normally. Once the sensor completes the measurement and reports the measurement results, it will enter the sleep state again. If you want to communicate with the sensor again, you need to send a modbus command with a wake-up code.

Mode 3: Mode 3 is that once the sensor is powered on, it will perform periodic measurements according to the period set by registers 0x32 and 0x33. After each measurement is completed, the current measurement results will be actively reported through the serial port. This mode is generally used in IoT integrated service providers, which is convenient for effective control of power consumption through power on and off.

3.3 Power consumption per mode

Operating Modes	Working power	Instantaneous power
Normal Mode (Modes 0	11.829mA	19.929mA
Trigger Mode (Mode 1)	13.712mA	19.289mA
Sleep Mode (Mode 2)	0.1874mA	11.6344mA

4 FAQ

Question 1: What can I do, if I cannot connect to the sensor by RS485.

If the user cannot get any response from the sensor serial port, there may be some errors, please check as follows.

1. Check if the sensor is working properly, by listening to the sound of the probe, if you hear a waving sound when you get close to the sensor, it means the sensor is working properly. You can also check the power consumption, the current is around 5mA-20mA, if the current is too large or too small, there may be a problem with the sensor, please contact **KACISE** for more support.
2. Check the slave ID (slave address), the sensor does not respond to the wrong slave address instruction unless the ID is the broadcast address 0x00. Therefore, the user can send the hexadecimal string 00 03 00 28 00 01 05 D3 to the sensor, and the sensor will respond to the host with the correct slave address.
3. Check the UART baud rate. The sensor can only accept commands if the baud rate matches. The default UART baud rate is 19200bps. The baud rate can be changed by modifying register 0x00 and restarting the sensor. It may be that the register has been changed incorrectly, so the sensor cannot execute the command. This problem can be solved by trying to find the correct baud rate by modifying the host baud rate, and trying to get the correct one from the sensor. Here is a better way, which is to send the hex string 00 03 00 28 00 01 05 D3 to the sensor while trying different baud rates.

After testing the above three steps, the problem will be solved.

Appendix : KUS550 Data Memory

KUS550 register list:

Addr. Hex (Dec)	Definition	Variable Description	Default Value (Hex)
0x00(0)	Baud rate	The value in this position must be between 3 and 9. 3=2400bps;4=4800bps;5=9600;6=19200;7=38400;8=57600; 9=115200	0x06xx
0x01(1)	unit	The upper eight bits are valid. **When the upper eight bits are 0,** the measurement result unit is 0.1 mm, which means the measurement distance or liquid level range is 0-6553.5 mm. **When the upper eight bits are 1,** the measurement result unit is 1/128 inches, which means the measurement distance or liquid level range is 0-512 inches. **When the upper eight bits are 2,** the measurement result unit is 1 mm, which means the measurement distance or liquid level distance is 0-65.535 meters.	0x00xx
0x07(7)	Second Channel Switch Near Point	This register represents the near point of the switch in switch mode, used to establish the output region for the second channel switch.	0x0000

0x08(7)	Second Channel Switch Far Point	This register represents the far point of the switch in switch mode, used to establish the output region for the second channel switch. This value must be greater than the near point distance of the switch (0x07). Note: For switch mode configuration changes, please refer to register 0x2C.	0x03FF
0x15(21)	Sensor Address	The value in this position must be between 1 and 253	0x0001
0x23(35)	Measurement type and output mode (analog and switch)	High eight bits definition: When the high eight bits = 0, the 485 output result is distance, and when the high eight bits = 1, the 485 output result is liquid level, 0 and 1 are legal data. Liquid level calculation method: Liquid level = far point distance (0x25) - measured distance. Low eight bits definition: This position defines the output mode of the sensor. When the low eight bits = 0, the sensor is in analog output mode, outputting analog signals 4-20mA/0-10V or other customized analog signals (such as 0-20mA). The analog quantity related registers are (0x24, 0x25, 0x26, 0x27) When the low eight bits = 1, the sensor is in switch output mode. The switch quantity related registers are (0x07, 0x08, 0x28, 0x29, 0x2C) Note: Due to hardware differences, the two outputs cannot be changed at will, and the output setting at the factory shall prevail.	0x0000
0x24(36)	Set analog near point distance	This register indicates the near-point distance in analog output mode. When the measured distance is equal to or less than the analog near-point distance, the output analog signal is equal to the setting value of the 0x26 register. Example: This register determines the corresponding distance of 4mA in 4-20mA.	0x0578
0x25 (37)	Set analog far point distance	This register indicates the far point distance in analog output mode. When the measured distance is equal to or greater than the analog far point distance, the output analog signal is equal to the setting value of the 0x27 register. Example: This register determines the corresponding distance of 20mA in 4-20mA.	0x7530
0x26 (38)	Set analog near point	This register is used to set the current/voltage output value of the analog near-point distance, and is used in analog output mode.	0x00FA

	current/voltage value	Note: The maximum value of the register must not exceed 0x280A, and cannot be equal to the value of the 0x27 register. Example: This register determines the size of 4mA in the 4-20mA output. It is not recommended to change the factory default value.	
0x27 (39)	Set analog far point current/voltage value	This register is used to set the current/voltage output value of the analog far-point distance, and is used in analog output mode. Note: The maximum value of the register must not exceed 0x280A, and cannot be equal to the value of the 0x26 register. Example: This register determines the size of 20mA in the 4-20mA output. It is not recommended to change the factory default value.	0x2738
0x28(40)	First channel switch near point	This register is the switch point near point in switch mode, used to establish the first switch output area.	0xAF0
0x29(41)	First channel switch far point	This register is the switch point far point in switch mode, used to establish the first switch output area. This value must be greater than the switch near point distance (0x28). Note: For switch mode changes, please refer to register 0x2C.	0x6A18
0x2B(43)	Fault output	This register indicates the analog output when the sensor is in measurement failure state, the default value is 10250 (20.6mA/10.3V).	0x280A
0x2C(44)	Digital output configuration	The upper eight bits are valid Switch output mode selection **bit4: Output when the target distance is less than the near point distance** When bit4=0, the detection distance is less than the near point setting distance, the switch is disconnected, or the output is 0V. When bit4=1, the detection distance is less than the near point setting distance, the switch is closed, or the output is a high voltage. **bit3: Output between the far point and the near point** When bit3=0, the output between the far point and the near point is determined by bit2; when bit3=1, the output does not change between the far point and the near point. **bit2: When bit3=0, the output between the far point and the near point is determined.** bit2=0: The detection distance is between the far point distance and the near point distance, the switch is disconnected, or the output is 0V.	0x05xx

		bit2=1: The detection distance is between the far point distance and the near point distance, the switch is closed, or the output is a high voltage. **bit1: Output when the target distance is greater than the far point distance** bit1=0: The detection distance > the set far point distance, the switch is disconnected, or the output is 0V. bit1=1: Detection distance > set far point distance, switch closed, or output is high voltage. **Bit0 output status setting when there is no echo.** Bit0=0: If there is no echo, set the switch to open, or output to 0V. Bit0=1: If there is no echo, set the switch to close, or output to high voltage.	
0x2F (47)	Operating mode and temperature options	**The upper eight bits are the working mode** Definition is as follows: **When the upper eight bits = 0**: In this mode, the sensor works normally, measures the results regularly and filters and calculates to save the measurement results. **When the upper eight bits = 1**: In this mode, the sensor remains silent, and the serial port will report the measurement results only when the host computer sends a query command. **When the upper eight bits = 2**: Sleep mode. In sleep mode, you need to send a modbus query command with a wake-up code before the sensor starts measuring and returns the measurement results. After receiving the wake-up code, the sensor will remain active within 50ms. During this 50ms, the host computer can send a normal modbus query frame or modify frame. During this period, the sensor will respond normally. Once the sensor completes the measurement and reports the measurement results, it will enter the sleep state again. If you want to communicate with the sensor again, you need to send a modbus command with a wake-up code. **When the upper eight bits = 3**: In this mode, once the sensor is powered on, it will perform periodic measurements according to the period set by registers 0x32 and 0x33. After each measurement is completed, the current measurement results will be actively reported through the serial port. This mode is generally used by IoT integrated service providers to effectively control power consumption by powering on and off.	0x0000

		The lower eight bits are temperature options The definition is as follows: **When the lower eight bits = 0**: use the internal temperature sensor as temperature compensation. **When the lower eight bits = 1**: use the host computer to write the temperature data to the 0x30 register for temperature compensation.	
0x30	Set temperature	When the lower eight bits of the 0x2F register = 1, the temperature of the register is set. The upper eight bits are valid.	0x00xx
0x32(50)	Measurement cycle	Set the minimum interval between two measurements.	0x0000
0x33(51)		The upper and lower bits of 0x32 are both valid, and the upper bit of 0x33 is valid. The default value is 0x000008FF. The default measurement time period is 8*25ms=200ms. Example: The measurement time period of 0x100000FF is 0x100000*25ms=1048576*25ms=26214400ms.	0x08FF

Measurement result register:

Addr. Hex (Dec)	Definition	Variable Description	Default Value (Hex)
0x100(256)	Status indication and restart	Status indication register (write any number to restart the sensor)	0x0000
0x101	Measurement results		0xxxxx
0x102	Measurement temperature	The lower eight bits are the signed value of the temperature.	

Note: The default unit of measurement results within a range of 6 meters is 0.1mm, and the default unit of measurement results for ranges greater than 6.5 meters is 1mm.

0x100 Status indication description:

Bit15																
Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Flag	HPER	LPER	RSV			TE	RSV	IERR	C	MT	Unit		Target	Vout	SWT	ERR

Bit Description:

Bit	Description
Bit0	=1 internal error, =0 normal
Bit1	Need to be in switch mode 0=switch off, =1 switch on
Bit2	=0 analog linear output, =1 switch output
Bit3	=0 target lost, =1 target detected
Bit4	=00 means the unit is 0.1mm =01 means the unit is 1/128inch
Bit5	=11 means the unit is 1mm
Bit6	=0 is distance mode, =1 is level mode
Bit7	=0 internal parameters are normal, =1 internal parameters are wrong
Bit10	=0 temperature detection is normal, =1 temperature detection is wrong

Other bits: reserved for factory testing